

Pinnacle Peak West Area Drainage Master Study

PCN 122.01.20 FCD 2011C024 WA#3

Executive Summary of the Hydrology and Hydraulics Technical Support Data Notebook

Prepared For:



FINAL

Prepared By:



JE FULLER

HYDROLOGY & GEOMORPHOLOGY, INC.

December, 2014

A122.112

Pinnacle Peak West ADMS Executive Summary

Introduction

The Pinnacle Peak West (PPW) Area Drainage Master Study (ADMS) will identify and evaluate flood hazards in the study area by implementing a work plan which includes data collection; review of previous planning and engineering studies; information gathering and sharing from/to project partners, stakeholders, and the public; hydrologic and hydraulic modeling; geomorphologic assessments; field surveys; landscape architecture; and environmental overview.

This executive summary only summarizes the methodology and findings of the hydrologic and hydraulic modeling of the watershed; refer to the Hydrology and Hydraulics Technical Support Data Notebook (TSDN) for more detailed information regarding the modeling and the items discussed in this summary.

The primary goal of the modeling component of the PPW ADMS is to update and characterize the flood hazard using current detailed topography, updated precipitation data, and two-dimensional modeling methodologies. Based on this updated understanding of the flooding hazard, this project may include formulation of flood hazard mitigation strategies to address the identified flooding hazards. The modeling results can also be used as input to the planning and design of drainage infrastructure and flood mitigation measures that are appropriate for the physical environment for both existing and future development.

Hydrologic analyses were performed for the 10-, 25-, and 100-year events. The results of the 10- and 25-year analyses are to be used for risk assessment purposes. The methods and results of the hazard and risk assessment are presented in the Task 12 and 13 – Hazard and Risk Memo provided under separate cover.

The results of the hydrologic and hydraulic analyses will be used to:

- More accurately characterize the location and extent of the existing flood hazards in the study area;
- Determine the adequacy of current and proposed drainage infrastructure;
- Plan and design future drainage infrastructure;
- Determine if there are practicable mitigation solutions that can reduce all or part of the flood hazard risk; and
- Compare to the effective FEMA floodplains and determine if additional floodplains should be delineated or if the existing floodplains should be redelineated.

Authority of Study

The Flood Control District of Maricopa County (District) has retained JE Fuller Hydrology and Geomorphology, Inc. (JEF) for completion of the PPW ADMS project. The District's contact and contract information is provided in Table 1 and the JEF contact information is provided below in Table 2.



Flood Control District of Maricopa County

INTEROFFICE MEMORANDUM

Date: April 2, 2015

To: William D. Wiley, P.E., Chief Engineer and General Manager

From: Theresa Pinto



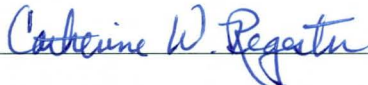
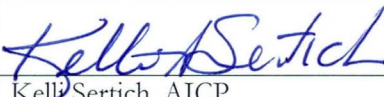


Subject: Pinnacle Peak West Area Drainage Master Study – Hydrology and Hydraulic Models and Results

The hydrology and hydraulic modeling for the Pinnacle Peak West Area Drainage Master Study (PPW ADMS) is complete and available to be used for this study area. The model results are based on the best available data at the time the model was developed, and standard modeling practices, assumptions, and engineering judgment. The models and results were thoroughly reviewed and approved by staff within the District's Engineering Division and Planning and Project Management Divisions.

The hydrology and hydraulic models were developed to identify flood hazards and risks in the PPW ADMS area. If the model results are used for other purposes, it is the user's responsibility to check the results for accuracy and applicability to their purpose. Furthermore, the results do not supersede or negate FEMA effective floodplains or any local, state, or federal floodplain or drainage regulatory requirements.

The results, models, and associated reports are available in the District's library. The report is titled "Pinnacle Peak West Area Drainage Master Study Hydrology and Hydraulics Technical Support Data Notebook December, 2014". The results and reports will also be available online in Spring/Summer 2015.

By signing below, you accept and approve the use of the PPW ADMS model and results as described herein.

 Theresa Pinto, AICP, PMP Project Manager	Date: 4-2-15	 William D. Wiley, P.E., Chief Engineer and General Manager	Date: 4/6/15
 Catherine Regester, P.E. Hydrology/Hydraulics Branch Manager	Date: 4/3/15	 Kelly Sertich, AICP Floodplain Management & Services Division Manager	Date: 4/6/15
 Scott Vogel, P.E. Engineering Division Manager	Date: 4/6/15	 Don Rerick, P.E. Planning and Project Management Division Manager	Date: 4/3/15

Pinnacle Peak West ADMS Executive Summary

Table 1. Flood Control District of Maricopa County Contact and Contract Information.

Authorizing Agency	<i>Flood Control District of Maricopa County (District)</i>
Contact Information	Theresa Pinto, AICP, CFM, PMP; Project Manager 2801 W Durango St., Phoenix, AZ 85009 602-506-8127 tmp@mail.maricopa.gov
Contract	Contract FCD 2011C024
Study Duration	Start Date: March 19, 2012; End Date: September 30, 2015

Table 2. Consulting Firm Information.

Primary Consulting Firm	<i>JE Fuller Hydrology & Geomorphology, Inc. (JEF)</i>
Contact Information	Patricia K. Quinn, PE, RLS, AVS; Project Manager 8400 S. Kyrene Rd, Ste. 201, Tempe, AZ 85284 480-222-5708 pat@jefuller.com

Location of Study

The PPW ADMS project study area is 97 square miles in size and is located in the northeastern portion of Maricopa County and encompasses land within the jurisdiction of the City of Phoenix, City of Scottsdale, Town of Cave Creek, Town of Carefree, and unincorporated Maricopa County. The primary stakeholders affected by the project are the City of Phoenix, City of Scottsdale, Maricopa County, and Arizona State Land Department (ASLD). The project is bound by approximately the Carefree Highway and Cave Creek Road to the north, the Pinnacle Peak South (PPS) ADMS study area and drainage divide to the east, the Central Arizona Project (CAP) Reach 11 Dikes to the south, and Cave Creek Road and the eastern Cave Creek floodplain limits to the west. The study area location and limits are shown in Figure 1.

Pinnacle Peak West ADMS Executive Summary

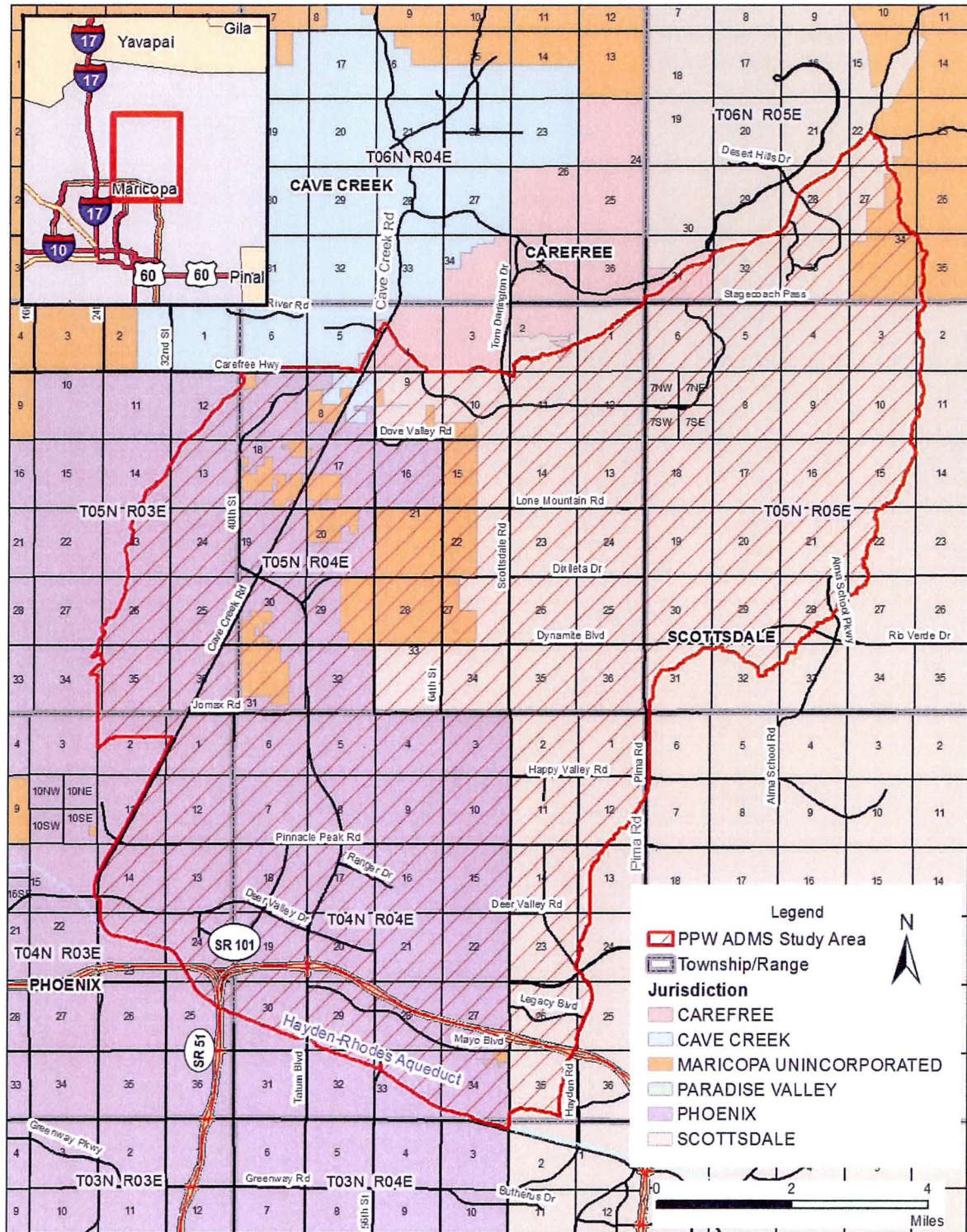


Figure 1. PPW ADMS Vicinity Map

Pinnacle Peak West ADMS Executive Summary

Methodology

Hydrologic and hydraulic (H&H) modeling for the PPW ADMS Project has been completed with the use of FLO-2D Professional Version FLO-2D (FLO-2D PRO), Build No. 13.07.05 and an executable dated 9-10-2013. The grid cell size used for all modeling is 20 feet by 20 feet. This 2-D modeling approach is highly suited for simulating the shallow, distributary flow prevalent within the watershed as flow travels from northeast to southwest through shallow braided channels in the undeveloped areas and through streets and around building structures in the developed areas. The models simulate rainfall/runoff for the 24-hour event with SCS Type II distribution using NOAA Atlas 14 rainfall data and Green and Ampt infiltration methodology. The FLO-2D model also incorporates building footprints using area reduction factors, hydraulically significant culverts, property walls, and channels within the model area. Significant storm drains within the model area are modeled as hydraulic structures. The models are developed using the existing land use conditions at the time of the TSDN documentation and were simulated under three scenarios related to property walls:

- *Without Property Walls* – There were no property walls were modeled.
- *With Property Walls and No Failure* – Property walls are modeled but walls were not failed regardless of ponding depth.
- *With Property Walls and With Failure* – Property walls are modeled but walls were failed when there was two feet of flow depth against them.

The PPW study area receives off-site flow from two sources, Unnamed Central Tributary to Cave Creek from the north (Carefree Drainage Master Plan) and the Pinnacle Peak South (PPS) ADMS from the east; see Figure 2 for locations. The PPW study area was subdivided into multiple model domains sub-areas due to the large watershed size and the grid cell size of 20 feet. Flow is passed from upstream sub-area model to the downstream sub-area(s) on a cell-to-cell basis along the overlapping sub-area boundaries. The nomenclature for the sub-area naming is based on prominent geographic features (e.g. Rawhide Wash) or master-planned communities (e.g. Desert Ridge) that lie within the vicinity of the sub-area domain. The prominent feature name and approximate model area for each sub-area model is listed in Table 3. See Figure 2 for the sub-area domain boundaries. Area R-11 is considered to be a unique condition as it overlaps with the Area DR and Area LR model domains, see the TSDN for a detailed discussion of Area R-11.

Table 3. PPW ADMS FLO-2D Model Sub-area Nomenclature Legend

Sub-Area ID	Prominent Feature Name	Area (mi ²)
Area LT	Legend Trail	12.0
Area UR	Upper Rawhide Wash	13.3
Area WR	Whisper Rock	15.1
Area TR	Tatum Ranch	15.7
Area LR	Lower Rawhide Wash	15.7
Area CB	Cave Buttes	9.9
Area DR	Desert Ridge	15.7
Area R-11*	Reach-11 Dikes	2.6**

*R-11 Model was developed to model the ponding of the Reach-11 Dikes upstream of the CAP canal.

**The area of the R-11 Model is included in the overlapping areas of LR and DR. The 2.6 square-mile area is not in addition to the total area.

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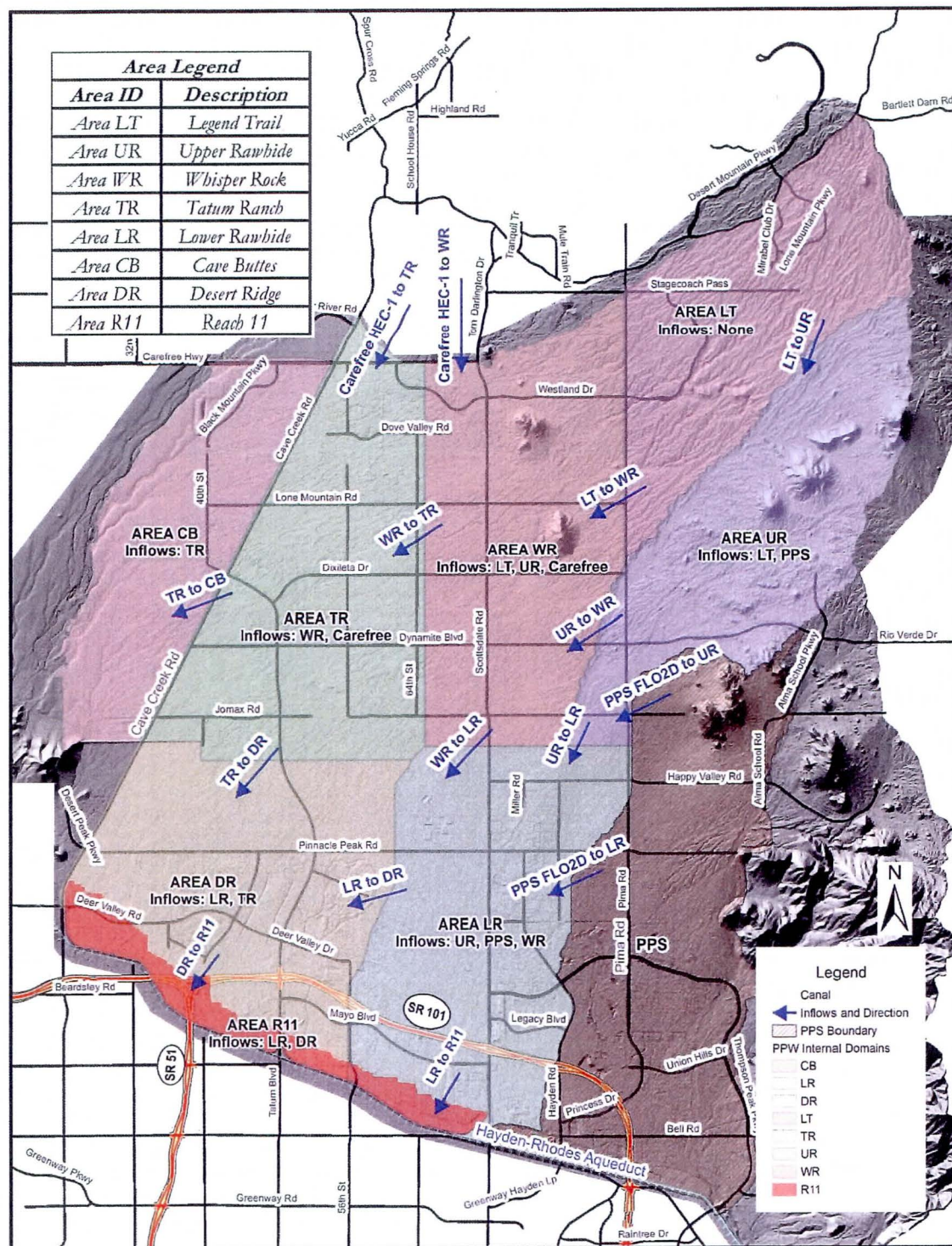


Figure 2. PPW ADMS FLO-2D Sub-Areas

Pinnacle Peak West ADMS Executive Summary

Results

The results of the FLO-2D modeling are located with the TSDN and are provided in exhibit and digital data formats. The digital data format is on a gridded basis and includes the flow depth, velocity, discharge, and water surface elevation for each grid. Approximately 1,600 floodplain cross-sections are located throughout the PPW study area and their locations are included with the TSDN digital data in GIS shapefile format. The results of the modeling were compared to a variety of data sources for modeling verification, these sources include FEMA FIS Data, the Cave Creek Below Carefree Highway FIS Floodplain Delineation Study, Upper Rawhide Wash Floodplain Delineation Study, North Scottsdale Floodplain Delineation Study, Indirect Methods Verification, and gage data from relevant recorded storm events. Although some discrepancies do exist between the PPW study results and the verification data sources, the results compare relatively well with the previous studies where applicable. The discrepancies are discussed in more detail in the TSDN. Figure 3 illustrates the worst-case 100-year flow depth results; the worst-case is a composite of the results of each wall scenario where the maximum flow depth for each grid from each scenario is shown in a single flow depth dataset.

As part of the outcome from this modeling effort, the results indicate that there are areas that can benefit from a redelineation of current effective FEMA floodplains, particularly in the northwestern region of the watershed. The modeling results are also being used to develop flooding mitigation alternatives for select flood hazards within the watershed. Furthermore, the results have identified existing flooding hazards within the study area and are used to develop a risk assessment analysis under Task 12 Flood Hazard Classification and Task 13 Flood Risk Determination as part of the overall PPW ADMS process and project purpose. These modeling results are also used as a planning tool to aide in the development and/or analysis of existing and future drainage and transportation infrastructure. Refer to Task 15 Alternatives to Reduce Flood Risk for flood hazard mitigation to buildings, transportation access, Rawhide Wash alluvial fan and other priority flood hazard areas.

Pinnacle Peak West ADMS Executive Summary

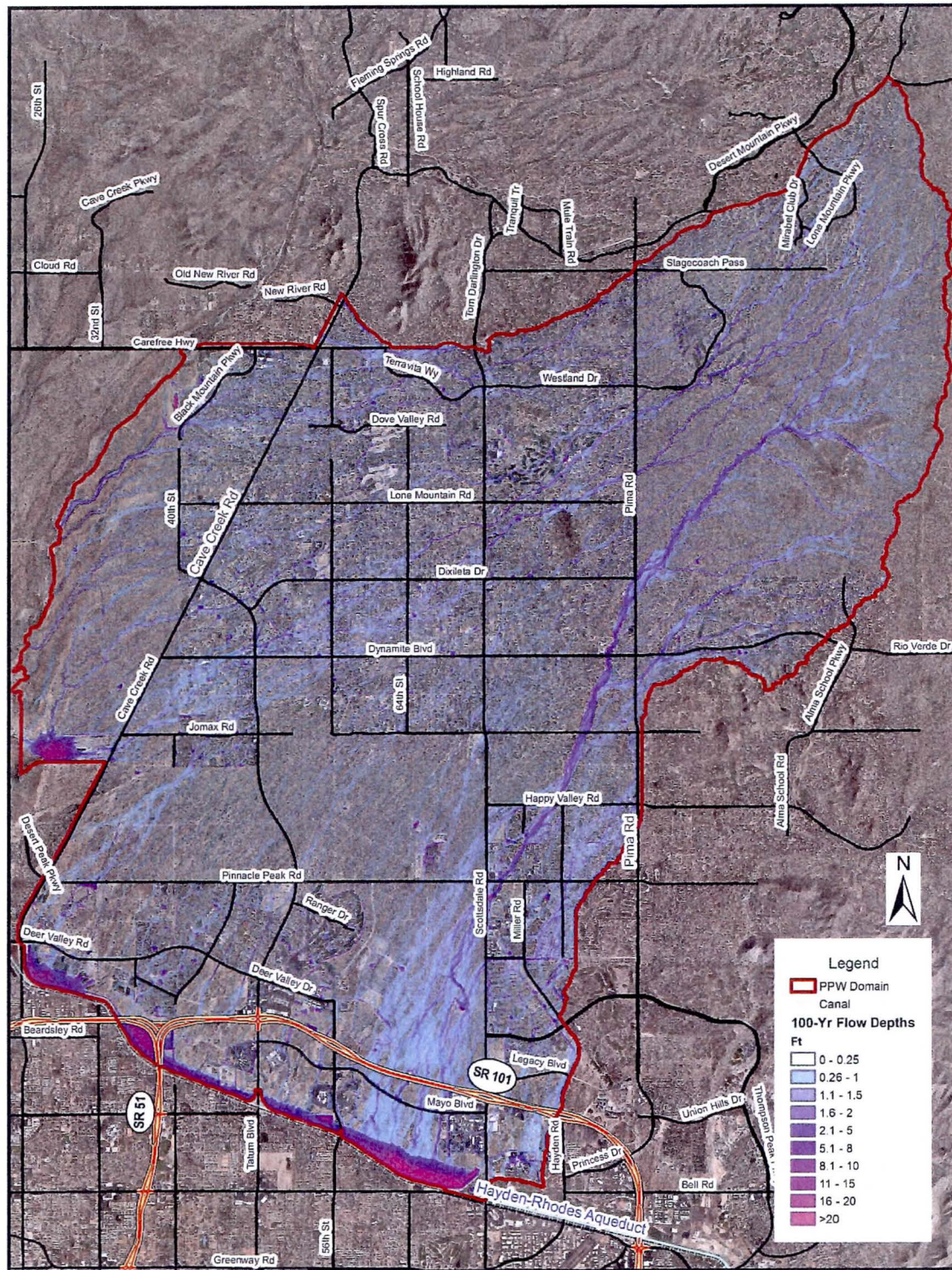


Figure 3. 100-Year Flow Depth Results